Investigation of Winter Mercury Levels in the Sharp-tailed Sparrow Complex in the Chesapeake Bay and Seaside of Virginia

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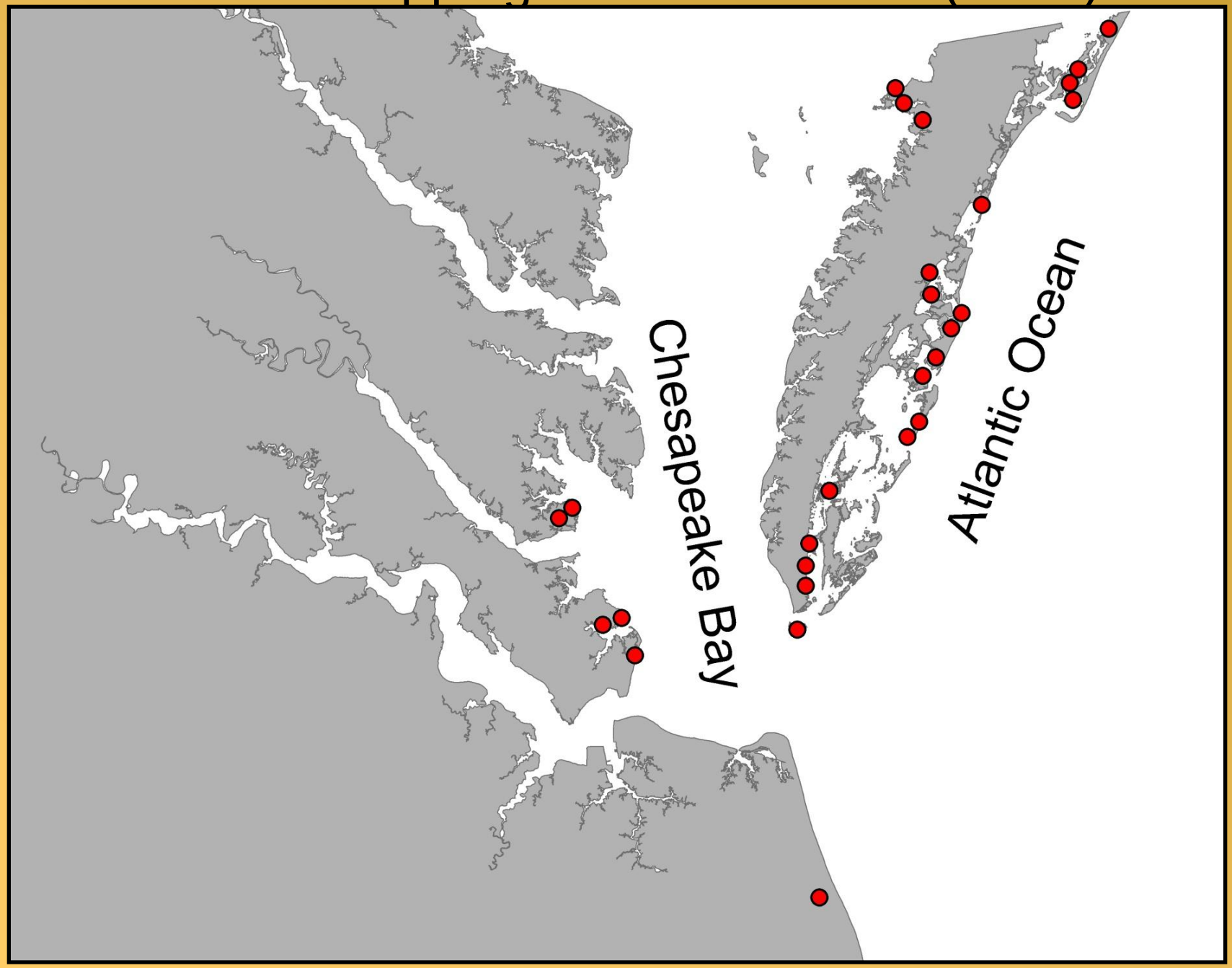
What's in a name?

Project Background

- CCB identified an information gap in wintering marsh birds on the Eastern Shore of Virginia. Study was initially tied to looking at the impact of *Phragmites australis* on the high marsh community (funded by NOAA/CZM).
- Marsh surveys began in winter of 2006, though identification to species was problematic for sharp-tails (initiated trapping to solve problem).
- We began trapping bayside marshes during the winter of 08-09.
- Began feather and blood collecting to look at mercury, isotopes, and genetic origin in sharp-tails in 2008-2011

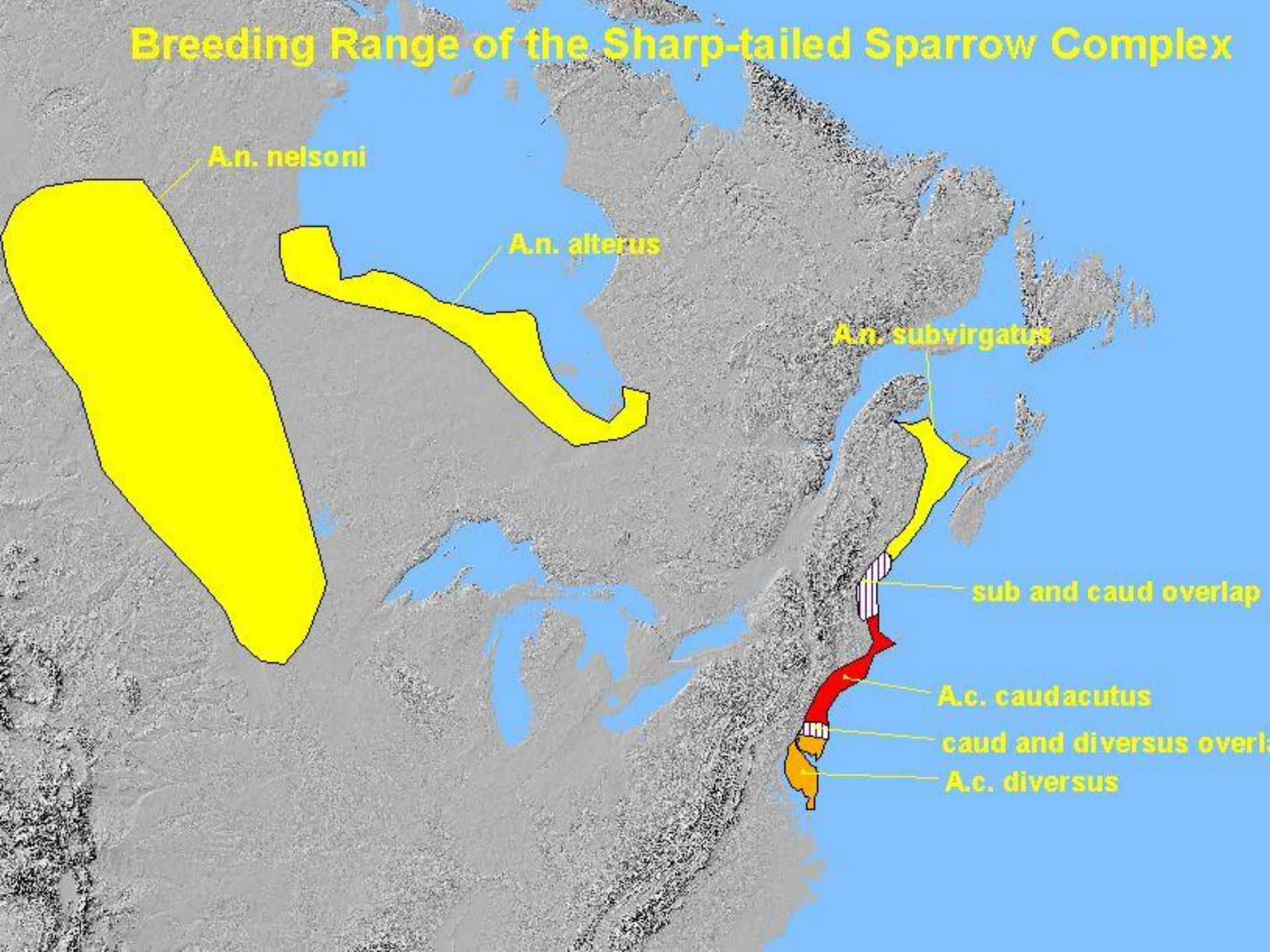
Winter trapping sites 2006-2011 (n=27)



Methods

- Modified rope-drag technique, with target netting of individuals
- Morphological measurements and ageing of birds
- Collection of feathers for isotope and mercury analysis and blood for mercury
- Photographic record at multiple angles of each capture

Saltmarsh vs. Nelson's


Breeding Range of the Sharp-tailed Sparrow Complex
A.n. nelsoni
A.n. alterus
A.n. subvirgatus
sub and caud overlap
A.c. caudacutus
caud and diversus overl
A.c. diversus

Species Breakdown for Winter Marshbird Trapping 2006-2010

Species	New Capture	Same Year Recap	Between Year Recap	Totals
Saltmarsh Sparrow	296 (41.9%)	50 (36.5%)	17 (38.6%)	363
Nelson's Sparrow	267 (37.8%)	73 (53.3%)	21 (47.7%)	361
Seaside Sparrow	89 (12.6%)	10 (7.3%)	6 (13.6%)	105
Marsh Wren	19 (2.7%)	1 (0.7%)	--	20
Savannah Sparrow	12 (1.7%)	--	--	12
Swamp Sparrow	10 (1.4%)	--	--	10
Ipswich Sparrow	6 (0.8%)	--	--	6
Song Sparrow	3 (0.4%)	--	--	3
Sedge Wren	2 (0.3%)	2 (1.5%)	--	4
LeConte's Sparrow	1 (0.1%)	1 (0.7%)	--	2
UID Sharp-tailed Sparrow	1 (0.1%)	--	--	1
Totals	706 (100%)	137 (100%)	44 (100%)	887

Species/subspecies Identification Tools

- Pyle Guide
- BNA account
- Greenlaw and Woolfenden paper in Wilson (2007)
- Examination of study skins at Smithsonian and the Royal Ontario Museum
- Photo essay in North American Birds 2011

Nelson's Sparrow Subspecies Identification

Known Location Breeding Nelson's Sparrow Subspecies

A.n. nelsoni

A.n. nelsoni cont…

A.n. alterus

A.n. alterus cont…

A.n. subvirgatus

A.n. subvirgatus cont…

A.c. caudacutus

A.c. diversus

Sharp-tailed Sparrows by Subspecies in Virginia:

Saltmarsh Sparrow			Nelson's Sparrow				
caudacutus	caud/div	diversus	nelsoni	alt/nel	alterus	alt/sub	subvirgatus
211 (80.0%)	25 (9.4%)	28 (10.6%)	46 (19.3%)	73 (30.7%)	91 (38.2%)	5 (2.1%)	23 (9.7%)
Total SSTS keyed to subspecies: 264			**Total NSTS keyed to subspecies: 238**				

Proportion of Subspecies for Bayside vs. Seaside Distribution

	Saltmarsh Sparrow			Nelson's Sparrow					
Location	**caudacutus**	**cau/div**	**diversus**	**nelsoni**	**alt/nel**	**alterus**	**alt/sub**	**subvirgatus**	**Totals**
Seaside	192 (82.4%)	17 (7.3%)	24 (10.3%)	40 (19.0%)	69 (32.7%	76 (36.0%)	5 (2.3%)	21 (10.0%)	444
Bayside	21 (67.7%)	6 (19.4%)	4 (12.9%)	6 (22.2%)	4 (14.8%)	15 (55.6%)	0	2 (7.4%)	58
	Total SSTS on Seaside Keyed to Subspecies: 233			**Total NSTS on Seaside Keyed To Subspecies: 211**					
	Total SSTS on Bayside Keyed to Subspecies: 31			**Total NSTS on Bayside Keyed To Subspecies: 27**					

Comparison of Species and Subspecies distribution within the Atlantic and Gulf Coast States

	Saltmarsh Sparrow			Nelson's Sparrow					
Location	caudacutus	cau/div	diversus	nelsoni	alt/nel	alterus	alt/sub	subvirgatus	Totals
Massachusetts[2]				1 (20%)	4 (80%)	--	--	--	5
New York[2]				--	1 (100%)	--	--	--	3
Maryland[2]				--	--	--	--	--	7
Virginia[1]				46 (19.3%)	73 (30.7%)	91 (38.2%)	5 (2.1%)	23 (9.7%)	502
Virginia[2]	[illegible]		[illegible]	--	--	--	--	--	6
North Carolina[2]	27 (37.5%)	5 (6.9%)	40 (55.6%)	31 (64.6%)	5 (10.4%)	11 (22.9%)	--	1 (2.1%)	120
South Carolina[2]	24 (33.8%)	3 (4.2%)	44 (62.0%)	63 (33.9%)	20 (10.8%)	58 (31.2%)	3 (1.6%)	42 (22.6%)	257
Georgia[2]	20 (33.9%)	2 (3.4%)	37 (62.7%)	26 (41.9%)	8 (12.9%)	18 (29.0%)	1 (1.6%)	9 (14.5%)	121
Florida (Atlantic Coast)[2]	41 (38.7%)	5 (4.7%)	60 (56.6%)	82 (55.6%)	9 (5.9%)	24 (15.7%)	--	38 (24.8%)	259
Gulf States[2,3]	7 (not ID'd to subspecies)			246 (90.1%)	8 (2.9%)	6 (2.2%)	4 (1.5%)	0	273
	Total SSTS Keyed to Subspecies: 587			**Total NSTS Keyed To Subspecies: 957**					

86.8% of all Nelson's Sparrows in winter

[1] CCB Unpublished Data, [2] Greenlaw and Woolfenden 2007, [3] Post 1998

Impact of Mercury on Reproductive Success

Parameter	n	r^2	F	P
Clutch initiation	118	0.002	0.24	0.62
Clutch size	118	0.009	1.11	0.30
Proportion eggs hatched	118	0.07	8.37	0.005*
Proportion nestlings fledged	114	0.04	4.49	0.04*
Proportion eggs fledged	114	0.12	15.09	<0.001*
Number fledglings produced	114	0.08	9.05	0.003*
Average egg size	13[a]	0.07	0.88	0.37

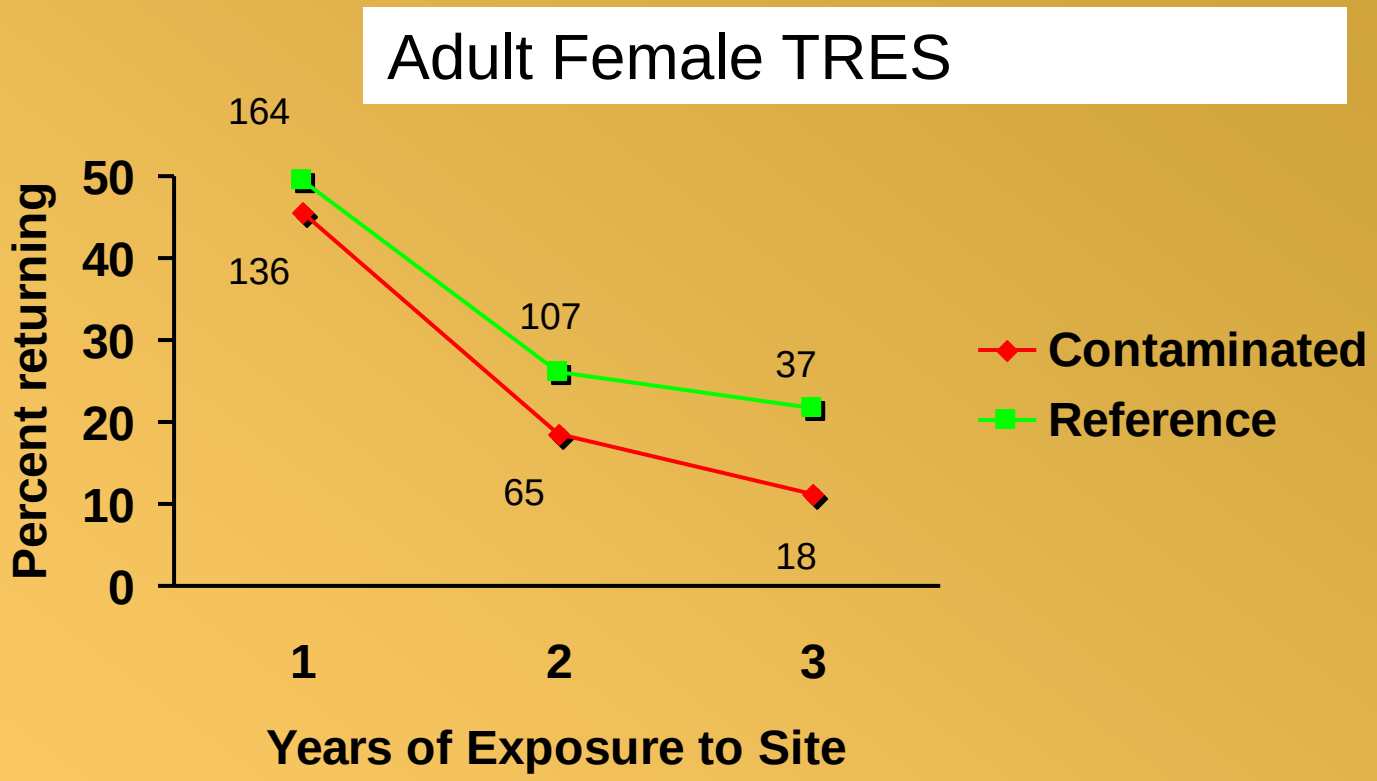
* Indicates a significant relationship

[a] Sample size is number of broods

Brasso and Cristol 2008

Adult survival from one year to the next

Sample size is number alive at end of previous year



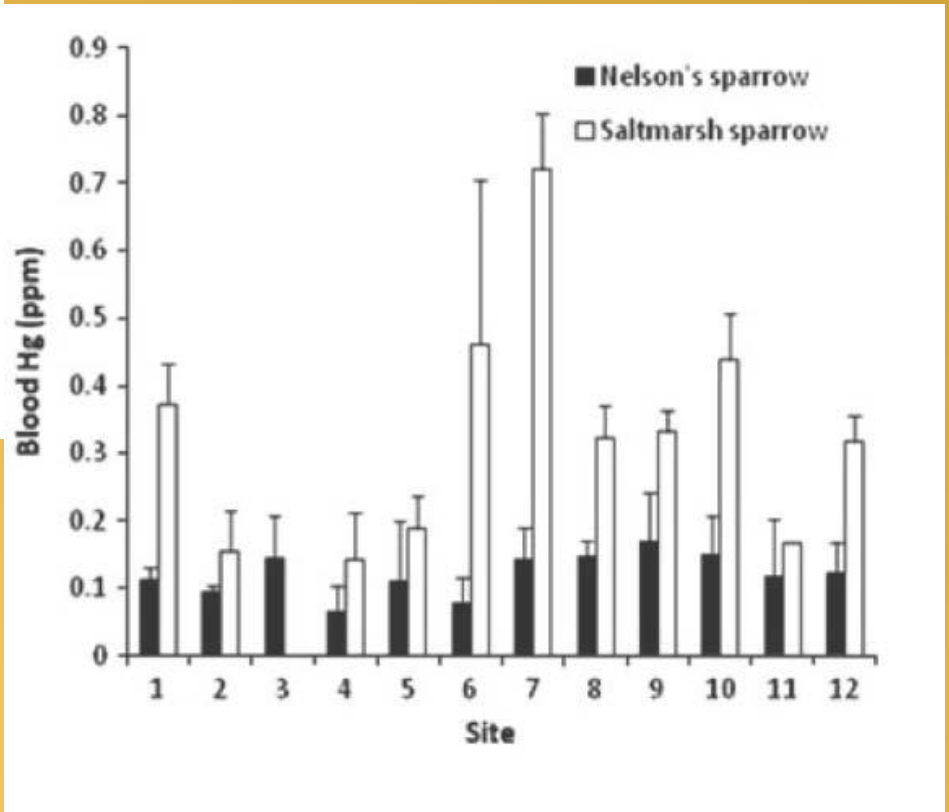
Birds nesting on contaminated sites were less likely to be alive the next year

Locations of blood/feather sample collections and results of blood mercury data

Table 2 Locations of sample collections in Virginia, USA

Site #	Location name	Latitude	Longitude
1	Assateague Bay	37.954654	−75.317580
2	Chincoteague	37.922407	−75.350723
3	Smalley Drain	37.912024	−75.367448
4	Tom's Cove	37.891455	−75.353260
5	Belinda	37.905207	−75.685916
6	Parramore Island	37.572239	−75.614844
7	Magotha	37.174903	−75.943232
8	Bull's Drive	37.142255	−75.941172
9	Fishermans Island	37.094062	−75.967886
10	Poquoson	37.111965	−76.325995
11	Maryus	37.277605	−76.410803
12	Monday Creek	37.282993	−76.385990

Back Bay NWR and Plum Tree Island NWR Excluded from analysis due to low sample size



Cristol et al. 2011

Comparison of winter vs. breeding

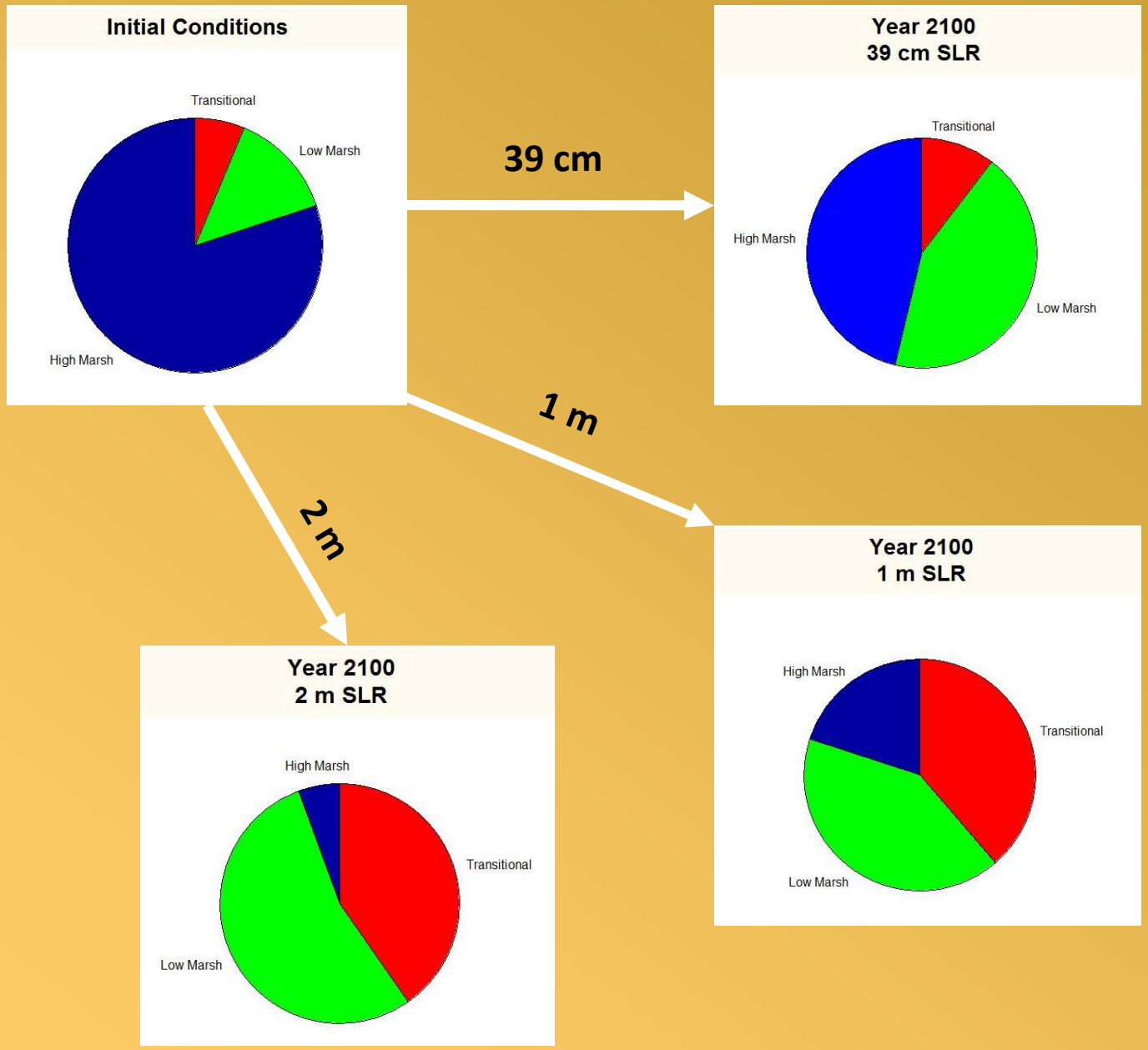
Table 1 Rangewide saltmarsh and Nelson's sparrow mercury (Hg) concentrations (ppm wet weight)

Location	Blood Hg (*n*) (range[a])	Feather Hg (*n*) (range[a])	Sampled	Reference
Ontario	0.22 (13) (0.14–0.36)	1.21 (14) (0.47–5.72)	Breeding Nelson's	Winder and Emslie, 2011
North Dakota	1.07 (24) (0.68–1.87)	0.98 (24) (0.34–3.19)		
Maine	0.69 (53) (0.56-0.87)	NA	Breeding saltmarsh	Shriver et al. 2006
	0.41 (28) (0.26–0.56)	NA		
	0.64 (229) (0.31–0.85)	NA		Lane et al., in press
New Hampshire	0.74 (95) (0.32–1.10)	NA		
Massachusetts	1.37 (160) (0.88–1.80)	NA		
Rhode Island	0.80 (81) (0.59–1.10)	NA		
Connecticut	0.50 (31) (0.24–0.61)	NA		
New York	1.01 (44) (0.68–1.50)	NA		
Delaware	0.48 (35) (0.40–0.54)	NA		Warner, 2009
Virginia	0.14 (130) (0.09–0.20)	2.76 (114) (1.81–4.74)	Wintering Nelson's	This study
	0.37 (127) (0.15–0.68)	6.25 (105) (2.96–10.76)	Wintering saltmarsh	
North Carolina	0.14 (47) (0.11–0.16)	2.94 (55) (2.57–3.80)	Wintering Nelson's	Winder and Emslie, 2011

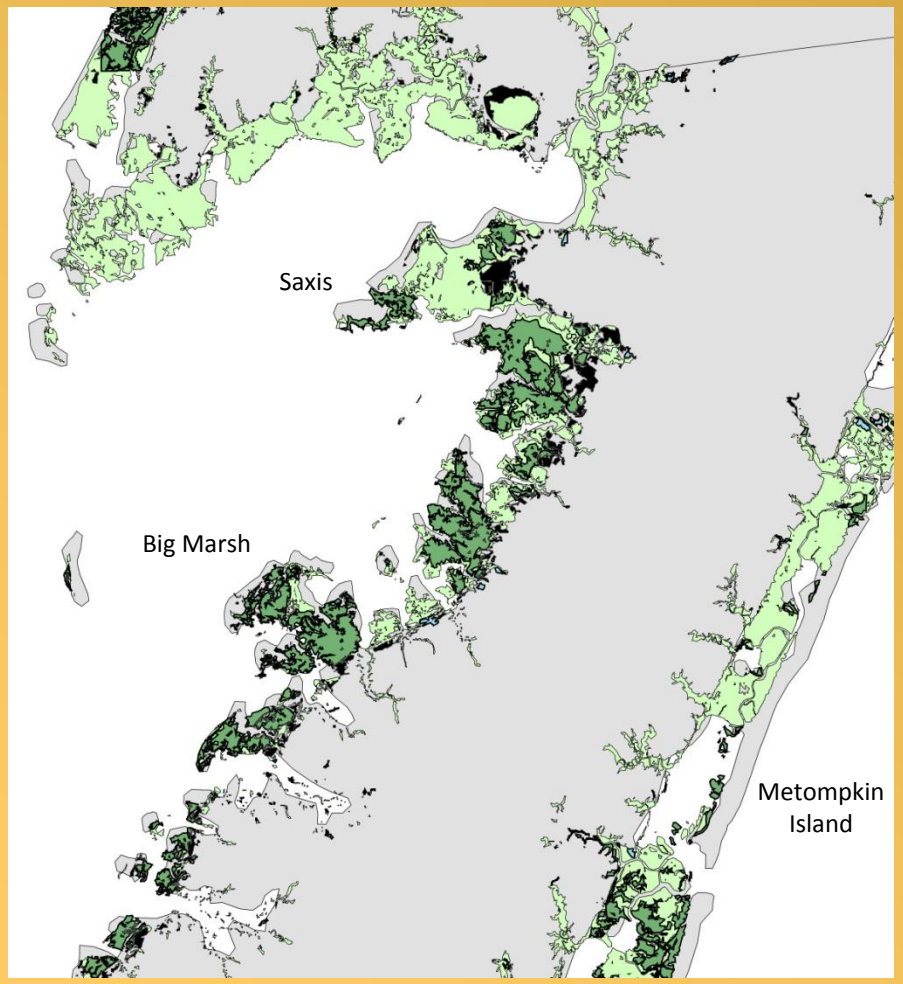
[a] Sample size represents individuals sampled. Range, for North Dakota and Ontario, where a single site was sampled, represents minimum and maximum individual values. At other locations multiple sites were sampled and range is minimum and maximum of site means

Cristol et al. 2011

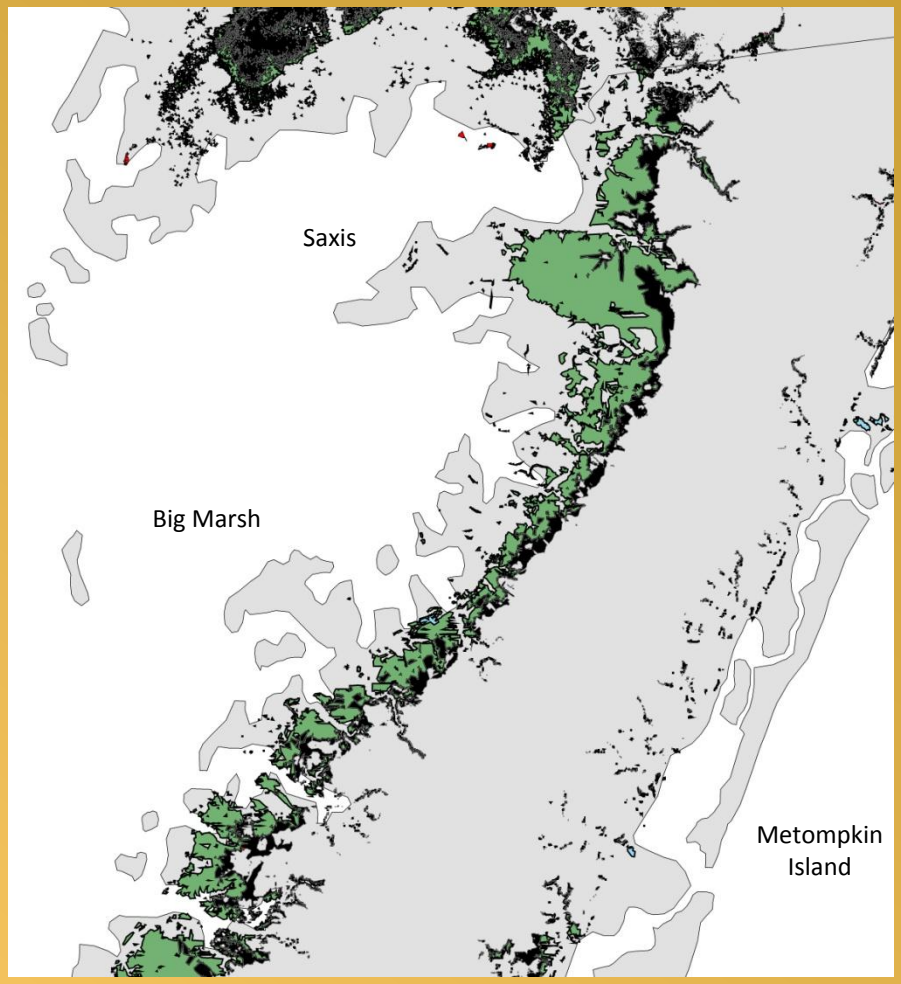
Potential impact of sea level rise on marsh sparrows



Current



Year 2100, 2m rise



Patty Glick
Jonathan Clough
Brad Nunley

Key Points

- All Saltmarsh Sparrows (a migratory bird) breed and winter within the borders of the USA. If we can't help them, well…
- Both species appear to "offload" mercury when wintering in Virginia (good news for people that like good news!)
- Parker River NWR appears to be a source population (obtained through genetics studies conducted by Adrienne Kovach). What is the impact of the high Hg loads?
- Virginia supports a much higher percentage of the sharp-tailed population in winter than could be gathered through a study of museum specimens
- Conservation concern is different among subspecies, a better understanding of winter range of subspecies on Atlantic Coast is needed.

Future Direction of Study

- Future work will involve a follow up season of trapping in Georgia to look at subspecies distribution (and possibly adding genetics and mercury sampling to that effort?) and retrapping sites in Virginia to look at year to year fidelity.

Acknowledgements

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Note on abnormal plumages

- First noted by A.T. Wayne in South Carolina. He collected about 25 partially leucistic Saltmarsh Sparrows between 1900 and 1921.
- Sibley (Birding 1996) notes approximately 1 in 50 ratio in Saltmarsh Sparrows, and rare occurrence in Nelson's.
- Our ratio is 7 out of 502 (.7 in 50, slightly lower than Sibley's speculation) birds captured, with one of those a Nelson's Sparrow.

A tale of two plumages

2006-2007 Season

2008-2009 Season

2006-2007 Season

2008-2009 Season